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Summary
Course of limitations in activities in elderly patients
with osteoarthritis of the hip or knee

As described in *chapter 1*, osteoarthritis (OA) is a chronic musculoskeletal disease, which typically occurs in older adults and usually concerns weight bearing joints such as hips, knees, feet and spine. It is characterized by progressive breakdown and eventual loss of cartilage and increased activity of the underlying subchondral bone. It causes pain, joint stiffness, reduced range of joint motion and muscle weakness. OA is the most common joint disorder in the Netherlands and throughout the Western world and frequently leads to functional problems, such as limitations in activities and participation restrictions. Little is known, however, about the course of limitations in activities over time in patients with OA. Furthermore, there is limited knowledge which factors predict the course of limitations in activities.

Knowledge about functioning in daily life is important in optimizing rehabilitation for elderly patients with hip or knee OA. Rehabilitation has traditionally been applied primarily to persons in youth and midlife. Likewise, little research has been directed towards aspects of rehabilitation in elderly patients. This, however, has changed in recent years. Successful ageing and achieving optimal functioning and fulfilment are key aspects in older age and in rehabilitation. This paradigm shift and the prediction that demographic development will lead to an increasing number of elderly people, makes rehabilitation of elderly patients and the aim to improve their level of functioning an important aspect of health research.

The overall aim of the current thesis was to provide knowledge on the course and prognosis of limitations in activities in OA of the hip or knee, focusing on body functions, comorbidity, cognitive functioning and psychological and social factors as potential determinants. It was hypothesized that the level of functioning in elderly patients is affected by factors related to ageing. In the elderly, the gradual development of physical impairments, comorbidity, cognitive impairments and psychological and social problems are common.

To investigate what was already known in the literature, a systematic review was carried out of studies describing the course of functioning in patients with osteoarthritis (OA) of the hip or knee and identifying potential prognostic factors. This systematic review is described in *chapter 2*. A systematic search was performed. Studies involving patients with hip or knee OA, > 6 months follow-up, and outcome measures on functional status or pain were included. Methodologic quality was assessed using a standardized set of 11 criteria; a qualitative data analysis was performed.

Approximately 6500 titles and abstracts were screened and 48 publications were considered for inclusion. Eighteen studies, four of which met the high methodological quality criteria, were included. For hip OA, there was limited evidence that functional status and pain do not change during the first three years of follow-up. After three years, however, a worsening of functional status and pain was seen. For knee OA, there was conflicting evidence for the first three years of follow-up and limited evidence for worsening of pain and functional status after three years. Furthermore, limited evidence was established for negative associations between future functional status and laxity, proprioceptive inaccuracy, age, body mass index, and knee pain intensity. In contrast, greater muscle strength, better mental health,

better self-efficacy, social support and more aerobic exercise were protective factors in the first three years. It can be concluded, that pain and functional status in hip or knee OA seem to deteriorate slowly, with limited evidence for worsening after three years of follow-up. In specific subgroups, prognosis in the first three years of follow-up was either worse or better, as both risk factors and protective factors were identified. Prognostic factors included biomechanical factors, psychological factors, clinical factors and treatment modalities. To strengthen the evidence, further high-quality longitudinal research on hip or knee OA functioning is needed.

To strengthen the evidence which was found in the literature, a longitudinal cohort study with a follow-up period of three years was performed in which elderly patients with osteoarthritis of the hip or knee were included.

Using baseline data the influence of comorbidity on functioning in patients with OA was studied and described in *chapter 3*. The objectives of the study were (i) to describe the prevalence of comorbidity and (ii) to describe the relationship between comorbidity (morbidity count, severity and the presence of specific diseases) and limitations in activities and pain in elderly patients with knee or hip OA using a comprehensive inventory of comorbidity. A cross-sectional cohort study was conducted in which 288 elderly patients with hip or knee osteoarthritis were included. Apart from demographic and clinical data, information about comorbidity, limitations in activities (WOMAC, SF-36 and timed walking test) and pain (VAS) was collected by questionnaires and tests. Statistical analyses included descriptive statistics, multivariate regression techniques, t-tests and one-way ANOVA.

Almost all patients suffered from at least one comorbid disease, with cardiac diseases, diseases of eye, ear, nose, throat and larynx, other urogenital diseases and endocrine/metabolic diseases being most prevalent. Furthermore, the majority (51.7%) of the patients were overweight and 23.6% suffered from obesity. Morbidity count and severity index were associated with more limitations in activities and with more pain. The presence of most of the moderate or severe diseases and obesity was associated with limitations in activities or with pain. In all, the results of this study emphasize the importance of comorbidity in the rehabilitation of elderly patients with osteoarthritis of the hip or knee. Clinical practitioners should be aware of the relationship of comorbidity with functional problems in OA patients.

To determine the relationship between body functions, comorbidity and cognitive functioning on the one side and limitations in activities on the other, in elderly patients with OA of the hip or knee, again baseline data were used. A cross-sectional cohort study, described in *chapter 4*, was conducted in which 288 patients with hip or knee OA were included. Patients were recruited from rehabilitation centers and hospitals (departments of Orthopedics, Rheumatology or Rehabilitation). Apart from demographic and clinical data, information about limitations in activities, body functions (pain, muscle strength, range of joint motion), comorbidity and cognitive functioning was collected by questionnaires and tests. Statistical analyses included univariate and stepwise multivariate regression analyses.

Self-reported limitations in activities (Western Ontario and McMaster

Universities Osteoarthritis Index) were significantly associated with pain, muscle strength knee extension, range of joint motion (hip flexion) and morbidity count. Performance-based limitations in activities (timed walking test) were significantly associated with range of joint motion (knee flexion, hip flexion, and knee extension), muscle strength hip abduction, pain, cognitive functioning and age. It can be concluded that self-reported limitations in activities in hip or knee OA are largely dependent on pain and to a lesser extent on range of joint motion, muscle strength and comorbidity. Performance-based limitations in activities are largely dependent on range of joint motion and muscle strength, and to a lesser extent on pain, cognitive functioning and other factors. These findings point to the role of body functions in limitations in activities in OA of the hip or knee. Although less important, comorbidity and cognitive functioning play a role as well.

Longitudinal data were used (i) to describe the course of limitations in activities in elderly patients with osteoarthritis of the hip or knee over a follow-up period of three years and (ii) to identify prognostic factors of the course of limitations in activities, focusing on body functions, comorbidity and cognitive functioning. Results of this longitudinal study are presented in *chapter 5*. A longitudinal cohort study with three years of follow-up was conducted. Patients (N=237) with hip or knee osteoarthritis were recruited from rehabilitation centers and hospitals (Departments of Orthopedics, Rheumatology and Rehabilitation). Outcome measures were patient-perceived change, self-reported limitations in activities (WOMAC) and observed limitations in activities (timed walking test). Prognostic factors were demographic data, clinical data, body function (pain, muscle strength, range of motion), comorbidity and cognitive functioning (cognitive decline, memory, attention). Measurements were done annually, at baseline and after 1, 2 and 3 years. Statistical analyses included t-tests, univariate regression analyses and multivariate regression analyses.

Self-reported limitations in activities measured by the WOMAC improved slightly after a three-year follow-up. In knee OA, reduced range of motion at one-year follow-up, increased pain at one-year follow-up and higher morbidity count predicted worsening of self-reported limitations in activities. In hip OA, reduced range of motion at one-year follow-up, increased pain at one-year follow-up, higher morbidity count or the presence of moderate-to-severe cardiac disease, and poorer cognitive functioning (memory) predicted worsening of self-reported limitations in activities. Performance-based limitations in activities measured by the timed walking test did not change after three years of follow-up. In knee OA, decreased muscle strength at one-year follow-up and higher morbidity count predicted worsening of performance-based limitations in activities. In hip OA, higher range of motion, higher morbidity count or the presence of moderate-to-severe cardiac and eye-ear-nose-throat disease, and older age predicted worsening of performance-based limitations in activities. Overall, it can be concluded that at group level, limitations in activities of patients with OA of the hip or knee recruited from hospitals and rehabilitation centers seem fairly stable during the first three years of follow-up. However, at the level of individual patients, considerable variation occurs. Prognostic factors for worsening of limitations in activities include increased pain, reduced range of motion and decreased muscle

strength at one year follow up; morbidity count; and to a lesser extent relatively poor cognitive functioning.

Although psychological and social factors have been studied separately, it is not known whether they have impact on the course of limitations in activities after controlling for established somatic and cognitive risk factors. Further analyses were performed, to determine whether psychological and social factors have impact on the course of limitations in activities in elderly patients with osteoarthritis of the hip or knee, in addition to established somatic and cognitive risk factors. Results are presented in *chapter 6*. A longitudinal cohort study with a follow-up period of three years was conducted. Patients (N=237) with hip or knee osteoarthritis were recruited from rehabilitation centers and hospitals. Body functions, comorbidity, cognitive functioning, limitations in activities and psychological and social factors (mental health, vitality, pain coping and perceived social support) were assessed. Statistical analyses included univariate and multivariate regression analyses. Psychological and social factors were added to the model developed in *chapter 5*.

In knee OA, low vitality predicted deterioration of self-reported and performance-based limitations in activities, after controlling for body functions and comorbidity. In hip OA, psychological and social factors had no additional contribution to the model. It can be concluded, that low vitality predicts deterioration of limitations in activities in elderly patients with osteoarthritis of the knee, in addition to established somatic and cognitive risk factors. Results of this study are highly relevant for the group of patients with knee or hip OA, attending hospitals and rehabilitation centers.

Chapter 7 discusses the main results of the study. Overall, the study showed that in elderly patients with osteoarthritis of the hip or knee, limitations in activities remain relatively unchanged in the first three years of follow-up. Despite stability at group level, there is considerable variation in the course of limitations in activities among patients: some patients improve, while others deteriorate. Identification of prognostic factors is therefore highly relevant. The results on prognostic factors showed that worsening of limitations in activities is influenced by body functions (reduced ROM, decreased muscle strength and increased pain at one-year follow-up), comorbidity and to a lesser extent cognitive functioning. Furthermore, in knee OA, the course of limitations in activities is also influenced by vitality. These results strengthen the evidence that was provided by the systematic review, described in *chapter 2* and emphasize once more that focusing on functional consequences in osteoarthritis of the hip or knee is very important.

The present study is the first to analyse the role of comorbidity in detail. Its importance is highlighted both in cross-sectional analyses and longitudinal analyses. Higher morbidity count was found to predict worsening of limitations in activities. In hip OA, the presence of moderate-to-severe cardiac disease and diseases of the eye, ear, nose, throat and larynx also predicted worsening of limitations in activities.

Results on prognosis are highly relevant for this specific group of patients, because it is expected that with the ageing of the population an increasing number

of elderly people with osteoarthritis of the hip or knee will need rehabilitation. This relevance is twofold: (i) prognostic factors can be used to inform patients on their expected future limitations in activities. The present results point to increased pain, reduced range of motion, decreased muscle strength, comorbidity and to a lesser extent worse cognitive functioning and low vitality as predictors of worsening of limitations in activities; (ii) prognostic factors can be used to set optimal rehabilitation goals. Rehabilitation might target pain, range of motion, muscle strength, comorbidity, cognitive functioning and vitality. Of course, intervention studies are required to substantiate claims on the effects of changing these prognostic factors.

Evidence in the literature suggests worsening of limitations in activities after three years of follow-up. To strengthen these results there is a need for further high quality research with a longer period of follow-up. Also, more research is required to substantiate claims on the effects of changing prognostic factors in rehabilitation in order to achieve better future functioning. Apart from focusing at how rehabilitation practitioners could change certain prognostic factors, research should be directed to what patients themselves can do, in order to achieve higher levels of future functioning. Finally, future research should focus on role of comorbidity, vitality and the presence and influence of depression in elderly patients with hip or knee OA.

Although studies in elderly patients are highly relevant, the physical demands of performing tests and answering questionnaires are a major challenge for research among the elderly. Furthermore, the use of valid and reliable instruments improves the quality of future studies. Uniformity in instruments will facilitate the summarizing of findings on the functional course in OA.